Title: Patterns, Paths, and Perimeters

Brief Overview:

Students will apply their knowledge of geometric shapes, standard units of measurement, and perimeter to create patterns and compare lengths using the theme of a Rain Forest.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*

- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*

- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*

- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*

- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*

- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

- **Content Standards**

  Geometry
- *Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships; identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes; classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids; investigate, describe, and reason about the results of subdividing, combining, and transforming shapes; explore congruence and similarity; and make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions.*
- *Specify locations and describe spatial relationships using coordinate geometry and other representational systems; describe location and movement using common language and geometric vocabulary; make and use coordinate systems to specify locations and to describe paths; and find the distance between points along horizontal and vertical lines of a coordinate system.*
- *Apply transformations and use symmetry to analyze mathematical situations; predict and describe the results of sliding, flipping, and turning two-dimensional shapes; describe a motion or a series of motions that will show that two shapes are congruent; and identify and describe line and rotational symmetry in two- and three-dimensional shapes and designs.*

- *Use visualization, spatial reasoning, and geometric modeling to solve problems; build and draw geometric objects; create and describe mental images of objects, patterns, and paths; identify and build a three-dimensional object from two-dimensional representations of that object; identify and draw a two-dimensional representation of a three-dimensional object; use geometric models to solve problems in other areas of mathematics, such as number and measurement; and recognize geometric ideas and relationships and apply them to other disciplines and to problems that arise in the classroom or in everyday life.*

Measurement

- *Understand measurable attributes of objects and the units, systems, and processes of measurement;understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute; understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems; carry out simple unit conversions, such as from centimeters to meters, within a system of measurement; understand that measurements are approximations and how differences in units affect precision; and explore what happens to measurements of a two-dimensional shape such as its perimeter and area when the shape is changed in some way.*

- *Apply appropriate techniques, tools, and formulas to determine measurements develop strategies for estimating the perimeters, areas, and volumes of irregular shapes; select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles; and select and use benchmarks to estimate measurements.*

- **Process Standards**

Problem Solving

- *Instructional programs from prekindergarten through grade 12 should enable all students to build new mathematical knowledge through problem solving; solve problems that arise in mathematics and in other contexts; apply and adapt a variety of appropriate strategies to solve problems; and monitor and reflect on the process of mathematical problem solving.*

Reasoning and Proof

- *Instructional programs from prekindergarten through grade 12 should enable all students to recognize reasoning and proof as fundamental aspects of mathematics; make and investigate mathematical conjectures; develop and evaluate mathematical arguments and proofs; and select and use various types of reasoning and methods of proof.*

Communication

- *Instructional programs from prekindergarten through grade 12 should enable all students to organize and consolidate their mathematical thinking through communication; communicate their mathematical thinking coherently and clearly to peers, teachers, and others; analyze and evaluate the mathematical thinking and strategies of others; Andes the language of mathematics to express mathematical ideas precisely.*

Connections

• *Instructional programs from prekindergarten through grade 12 should enable all students to recognize and use connections among mathematical ideas; understand how mathematical ideas interconnect and build on one another to produce a coherent whole; and recognize and apply mathematics in contexts outside of mathematics.*

Representation

• Instructional programs from prekindergarten through grade 12 should enable all students to:create and use representations to organize, record, and communicate mathematical ideas;select, apply, and translate among mathematical representations to solve problems; and use representations to model and interpret physical, social, and mathematical phenomena.

Grade/Level:

Grades 2-3

Duration/Length:

Four days

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

• Geometric shapes
• Use of standard ruler
• How to measure basic perimeters

Student Outcomes:

Students will:

• construct patterns using pattern blocks.
• demonstrate and construct growing patterns.
• measure perimeters.
• compare lengths of paths and perimeters.

Materials/Resources/Printed Materials:

• The Great Kapok Tree by Lynne Cherry
• Teacher Resource Sheets 1 and 2
• Overhead pattern blocks (if available)
• Pattern blocks (enough for each student to have 4 trapezoids, 4 triangles, 4 squares and 4 rectangles)
• Student Resource Sheets 1-9
• Linker cubes (20 cubes per student)
• String

Development/Procedures:

Day 1 - Patterns

Warmup:
◇ Gather children in the reading area.
◇ Show them the cover of The Great Kapok Tree.
◇ Ask where they think the setting for the book will be.
◇ Tell them it will be in the Rain Forest in South America
◇ Show the map at the beginning of the book indicating the present and original Rain Forests.
◇ Ask them why they think there is a difference between the present and the original Rain Forests.
◇ Tell them that you will find out after reading the book.
◇ Read the book.
◇ Discuss and record information about the animals and their characteristics as mentioned in the book.

Procedure:
◇ Show three animal picture cards. (Teacher Resource Sheet #1) You should have enough to make a pattern.
◇ Each card should have magnetic tape on the back.
◇ Create a pattern with the cards on the board (example: monkey, toucan, lizard, repeat)
◇ After showing the pattern twice, show it again leaving out the last animal for students to predict which animal would come next.
◇ Repeat this activity with a different pattern of the same three animal cards.
◇ Repeat this activity using four animal cards. Show two different patterns.
◇ Hand out pattern blocks to each student.
◇ Students will be given 5 minutes for exploration time with the blocks.
◇ Teacher models a pattern with overhead pattern blocks (if available) or draws a pattern on the board.
◇ Student copies pattern with their blocks and continues the pattern.
◇ Hand out Student Resource Sheet #1 for students to complete.
◇ Begin the next activity by modeling"Growing Patterns."
◇ Hand out Linker Cubes to pairs of students.
◇ Teacher models with cubes on overhead while students copy at their desk :
◇ Continue the pattern by adding one cube to the horizontal axis and two to the vertical axis:

◇ While you are adding to the pattern, have volunteers come to the overhead to place the next cube.
◇ Hand out Student Resource Sheet #2- grid paper. Model the beginning of a growing pattern for children to copy and complete on the grid paper.

Day 2 - Paths

Warmup:
◇ Review information about the Rain Forest by using Concept Attainment. On the board/chart paper, draw a tree large enough to write in. Write the name of an animal from the Rain Forest and a characteristic of the Rain Forest. Call on volunteers to add names to the tree (only animals/characteristics of the rain forest can be written on the tree. All others are written outside the tree.

<u>Procedure:</u>
◇ Distribute Pattern Blocks. Students remove ONLY the trapezoids and triangles.
◇ Students will place the first triangle with a vertex pointing down. They will place the second with a vertex pointing up. Students will repeat these moves to create a patterned path.
◇ Students will place trapezoids over triangles to discover how many triangles can be covered by each trapezoid.
◇ Ask: How many trapezoids did it take to cover the triangles?
◇ Distribute <u>Student Resource Sheet #3</u>, "A Path Through the Rain Forest". Allow students time to complete this activity.
◇ Draw the four layers of the Rain Forest on Chart paper/board as shown on <u>Teacher Resource Sheet #2</u>.
◇ Teacher reads the names of each layer and points to the animal on the forest floor.
◇ Ask: How can this animal get from the forest floor to the emergent layer?
◇ Distribute <u>Student Resource Sheet #4</u>. Have students use a finger to trace a path from the animal to the Emergent layer. The path does not have to be straight.
◇ Students trace this path with a pencil.
◇ Ask students to find and trace a second, different path to the Emergent layer with a crayon.
◇ Ask: Which path do you think will get the animal to the Emergent layer fastest?
◇ Why? How will we find which path is faster? (measure them)
◇ Distribute rulers and string. Demonstrate how to use and measure lines that are not straight with yarn by laying the yarn on the curved line, cut it where the path ends, and measure the yarn with the ruler. Do this for both paths. Distribute <u>Student Resource Sheet #5</u>. Allow time for students to complete this task.

Day 3 - Perimeters

<u>Warmup</u>: <u>Student Resource Sheet #6</u>, "Complete the Patterns"

<u>Procedure:</u>
◇ Tell students that boa constrictors live in the Rain Forest.
◇ Draw a boa constrictor on the board in a horizontal position.
◇ Ask students to predict how long they think it is. Measure with a ruler.
◇ Ask students what shape they think will fit around the boa constrictor.(rectangle)
◇ Draw a rectangle around it and tell the children that we are going to determine how big a frame we need to go around the boa constrictor.
◇ Ask the students what they have learned in math that will help them solve this problem.
◇ Elicit from the students their understanding of perimeter.
◇ Demonstrate how to find the perimeter. Repeat this activity with another
◇ animal or insect.
◇ Distribute <u>Student Resource Sheet #7</u>, "Frame the Animals".
◇ Put books out about the Rain Forest for children to look through.
◇ Distribute <u>Student Resource Sheet #8</u> , "Rain Forest Perimeter".

Performance Assessment:

Day 4 - Performance Assessment

• "Moving to a New Habitat" - discuss with children the present condition of the rain forests and why they are disappearing. (Refer to books or other information gathered during the week). Students will be given a vignette that will assess their ability to create a pattern and to measure length.

• Distribute Performance Assessment, <u>Student Resource Sheet #9</u> and pattern blocks. Read it aloud to children.
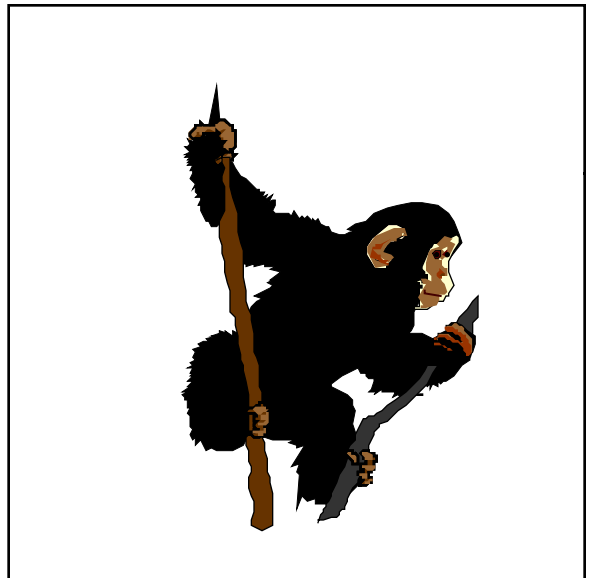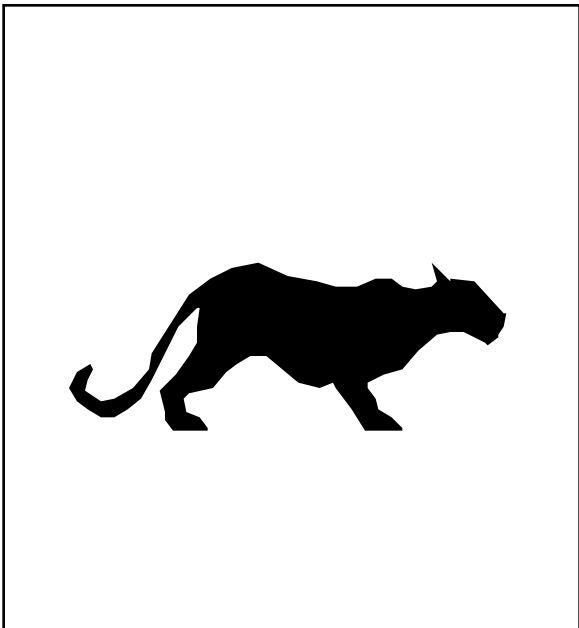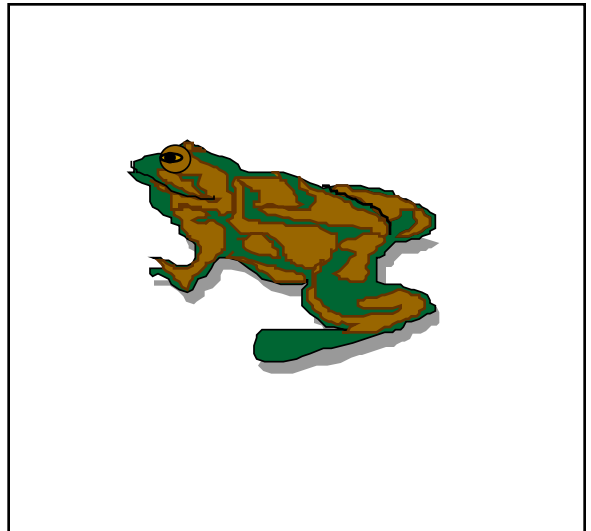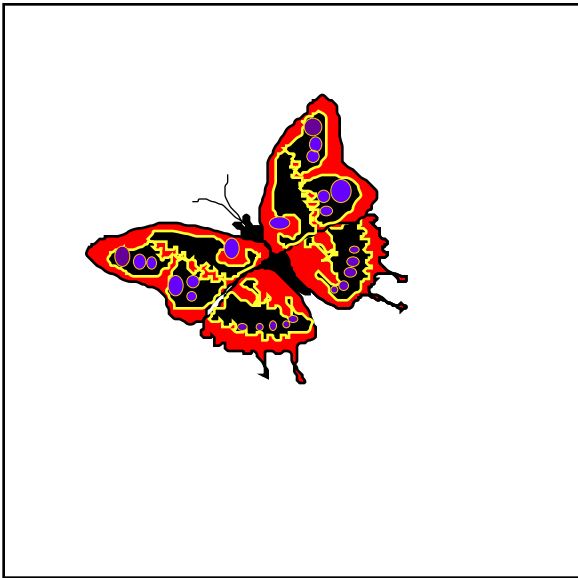
Extension/Follow Up:

Students can visit various web sites to reinforce pattern, measurement, and perimeter:

• funbrain.com
• mathcat.com
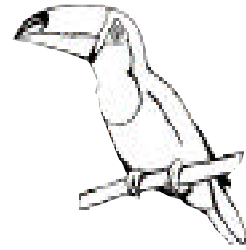• http://www.howard.k12.md.us/wray
• nctm.org

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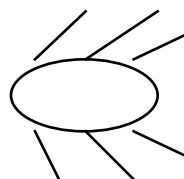
Peggy Garner
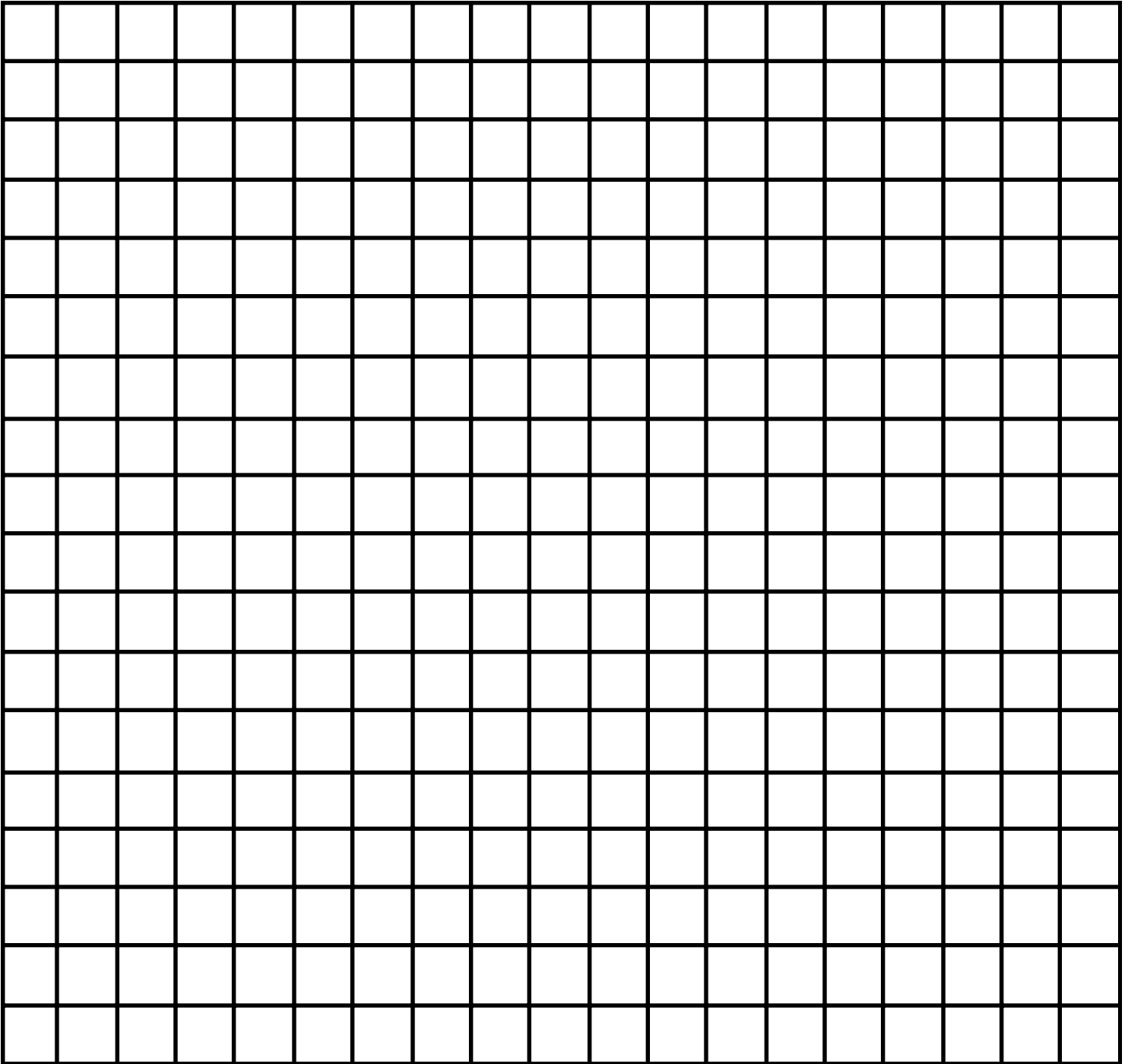St. Mary's Bryantown
Charles County, MD

Emergent Layer

Canopy Layer

Understory Layer

Forest Floor

CREATE YOUR OWN PATTERN

In the space below, use your pattern blocks to create a pattern. Trace each block and color them.

A Path Through the Rain Forest

Make a straight path through your own Rain Forest. Start at the jaguar. Using a triangle with the vertex down, make continuous **turns** until you reach the tree. Trace your triangle with a yellow crayon each time you make a turn.

1. How many triangles did you need to make your path?
    _____ triangles

2. Place a trapezoid over your triangles.

3. Outline your trapezoids in blue.

4. How many trapezoids did it take to make your path?
    _____trapezoids

Emergent Layer
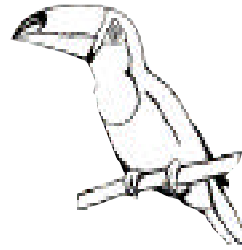
Canopy Layer

Understory Layer

Forest Floor
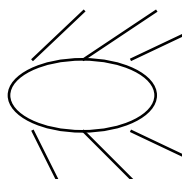
The Fastest Path Through the Rain Forest
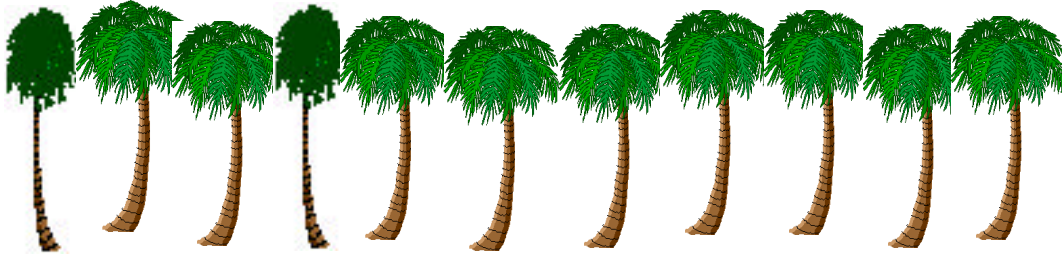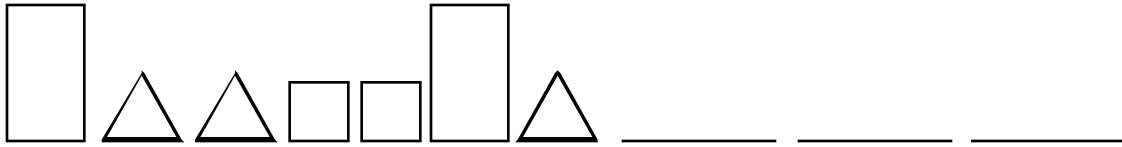
1. Path number one measured _____ inches.

2. Path number two measured _____ inches.

3. Which path will get the beetle through the Rain Forest the fastest? _____

4. How do you know which path is the fastest?

_____

_____

_____
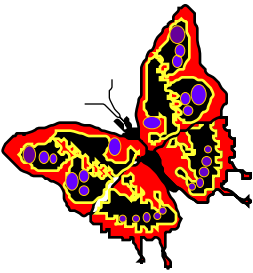
Continue the Pattern

□ □ △ ▱ □ ___ ___ ___

□ △ △ □ □ □ △ ___ ___ ___

▽ △ □ □ ▽ ___ ___ ___

___ ___ ___

___ ___ ___
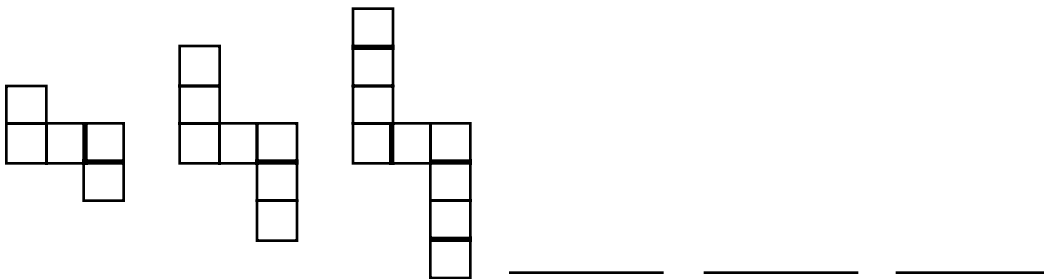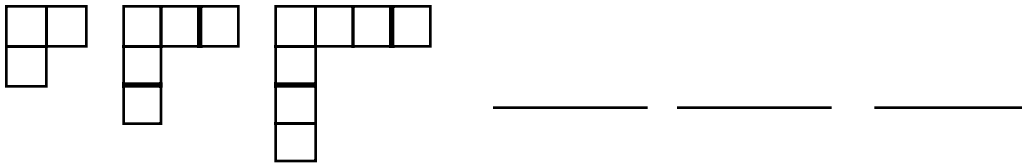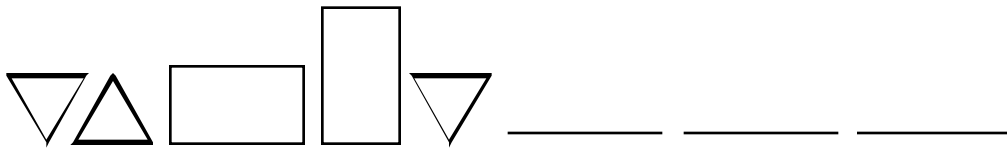
A B C A B __ __ __
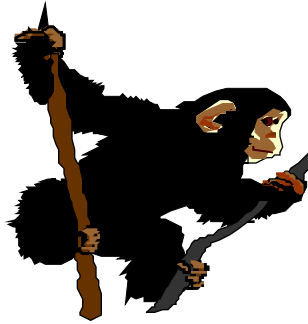
A A B B C C A __ __ __
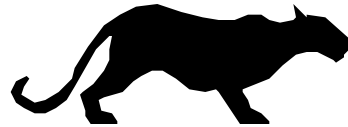
A B B C A B __ __ __

Framing Animals

Frame each animal with a shape. Find the perimeter
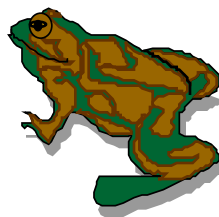of each frame.

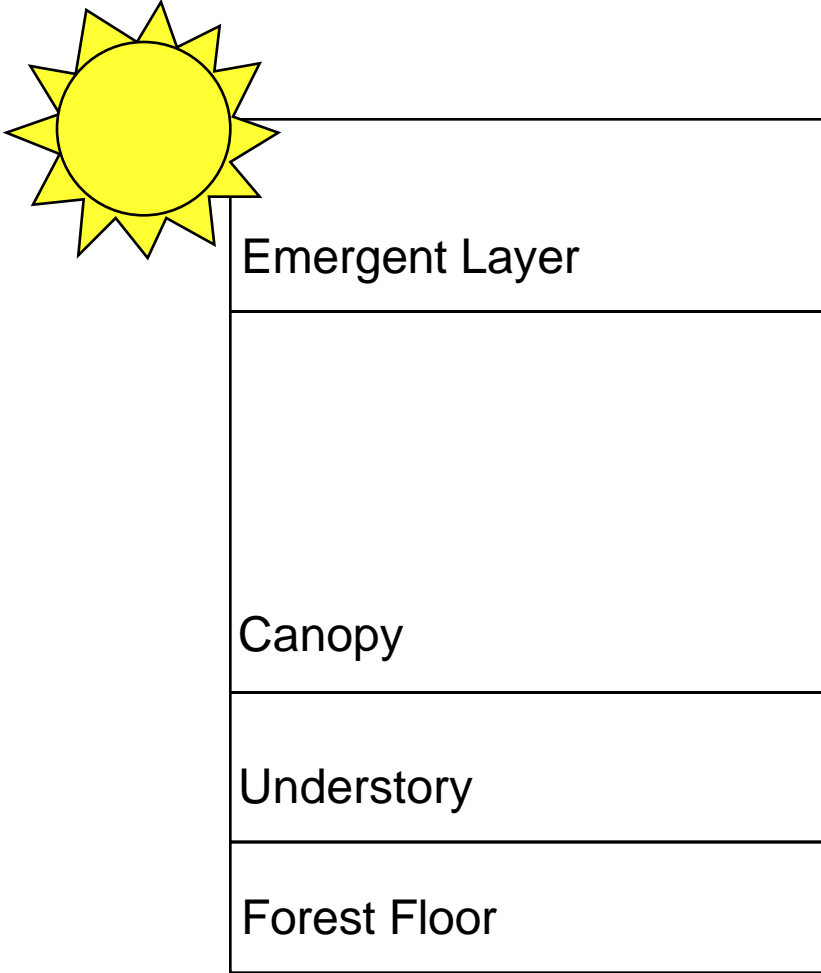_____perimeter   _____perimeter   _____perimeter

_____perimeter   _____perimeter   _____perimeter

Rain Forest Perimeter

In our rain forest we have it divided into four sections.
Measure each section. Write the measurements on each side.
Draw a rain forest animal in each level.

Emergent Layer

Canopy

Understory

Forest Floor

Which layer gets the most sun? _____

Which layer gets the least amount of sun? _____

Why? _____

Which is the largest layer? _____

What is the perimeter of our rain forest? _____

Performance Assessment

Finding a New Habitat

Today the Rain Forest is being destroyed by loggers cutting down trees, leaving animals homeless. Help the animal move to another Rain Forest. Make a path to the new habitat by creating a repeating pattern with your pattern blocks. Trace and color each block.
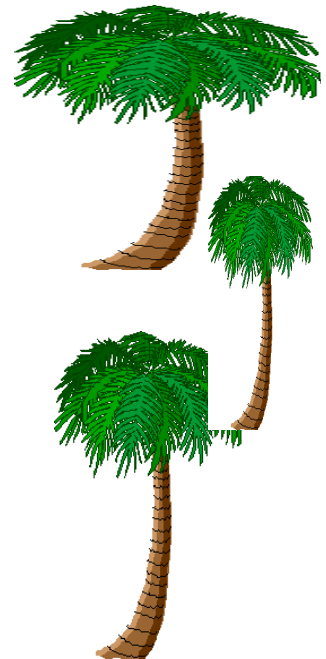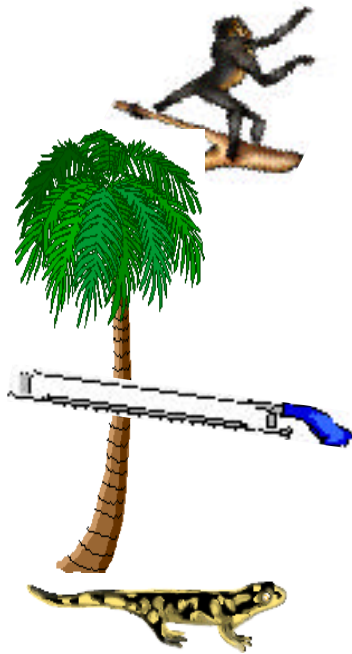
1. How far did the animals travel? Each inch equals
   5 miles.   _____miles

2. What must be in the new habitat for the animals
    to survive?_____
    _____
    _____

Rubric for Finding a New Habitat

3
- Student has a repeating pattern.
- Correctly counts length.
- Names at least one thing needed in a new habitat.

2
- Student has a repeating pattern.
- Correctly counts length.

1
- Student has a repeating pattern.

0
- Did not correctly accomplish any part of the task.